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Policy options and actions for expediting progress in implementation: waste management

Report of the Secretary-General

Summary

Waste management and waste minimization represent challenges for all countries, and in developing countries, with their growing economies, rising incomes and rapid urbanization, all leading to rising waste volumes, those challenges are mounting. For dynamic urbanizing economies, defining a long-term waste management strategy for the coming decades is critical to fostering sustainable waste management. An effective long-term strategy should include the operationalization of integrated sustainable waste management systems.

Understanding the scale of generation of various categories of waste is fundamental to formulating appropriate policies. A number of new waste streams have emerged or have assumed greater importance, especially e-waste and hazardous waste streams. In many cases, conventional waste management systems need to be modified and upgraded, as they were not designed to address these trends.

Implementation of waste management strategies requires coordinated efforts by international agencies, local governments (within their jurisdictions), national Governments, civil society, the informal waste sector and the private sector. Reducing waste production, recycling waste and reusing materials form the basis of sustainable waste management. Municipal solid waste management in many developing countries requires strengthening, and in this regard the availability of financial resources for building waste management infrastructure and of technical and managerial skills for system management need to be enhanced. Public-private partnerships could be further explored as a means of increasing availability of and access to financial resources.

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I. Introduction

1. The present report is a contribution to the discussions to be held at the Intergovernmental Preparatory Meeting on policy options and possible actions to expedite progress in waste management. It responds to the challenges and obstacles highlighted in the report of the Commission on Sustainable Development at its eighteenth session (E/CN.17/2010/15). The present report was prepared jointly by the Department of Economic and Social Affairs of the United Nations Secretariat and the United Nations Environment Programme (UNEP). It draws on inputs provided by the United Nations system, in particular the secretariat of the Basel Convention on the Control of the Transboundary Movements of Hazardous Wastes and their Disposal,[1] the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Industrial Development Organization (UNIDO) and the International Atomic Energy Agency (IAEA). The report should be read in conjunction with the report of the Secretary-General on sustainable consumption and production, which will also be before the Commission's Intergovernmental Preparatory Meeting.

II. Strategy and policies for waste management

A. Defining a long-term waste management strategy within the context of sustainable development and poverty eradication

2. Waste management and waste minimization are challenges everywhere, and in developing countries, with their growing economies, rising incomes and rapid urbanization, all leading to rising waste volumes, those challenges are mounting. The barriers to effective management and minimization include lack of data, information and knowledge on waste scenarios, lack of comprehensive regulations and weak enforcement of existing legislation, weak technical and organizational capacities, poor public awareness and cooperation, and lack of funds. The institutional framework has generally been weak, with very few, or no national associations or city champions in the field of waste management.

3. Priorities, policy and regulatory frameworks, institutional capacities and "maturity" of the waste business are at different levels across the world. While some countries have positioned waste as a resource in the national economy, many countries in the developing world, especially low-income countries, are still struggling to provide basic infrastructure and services for waste collection and disposal. It is therefore important that the right enabling framework be established on a timely and comprehensive basis to address local circumstances. At the same time, all countries could benefit from an approach that aims at waste minimization as well as the recovery, recycling and reuse of various waste types as productive resources.

4. Coping with waste management would benefit from a shift to sustainable consumption and production and a delinking of economic growth and environmental degradation. Governments at all levels, businesses and consumers need to make significant changes in their policies, activities and choices if they are to achieve the

[1] United Nations, *Treaty Series*, vol. 1673, No. 28911.

shift to sustainable consumption and production. The waste strategy should ideally address the whole life cycle, beginning with minimization of waste — including through eco-efficient product design — and continuing through to recycling and reuse (two of the 3Rs), with disposal only of those residuals not recyclable and reusable at acceptable cost and then only in an environmentally and socially sound manner. Closed-loop systems based on industrial ecology — where one firm's or industry's waste becomes other firms' or industries' raw materials — constitute a useful model whose adoption would be desirable. Japan is one example of a country that has implemented successful policies towards waste minimization and effective recycling, resulting in relatively low quantities of waste disposed per capita (430 kilograms (kg) per capita, which is only about two thirds of the Organization for Economic Cooperation and Development (OECD) average and on a par with the figure for South Africa).[2] All countries, even those that have progressed farthest, need to achieve much greater progress if there is to be any possibility of realizing the ultimate objective of "zero waste" economies and societies.

National policies and strategies

5. Traditionally, national waste management policies and strategies have been largely an end-of-life activity, though recycling rates have risen in many countries and, with respect to some materials in some countries, are already high. Recycling in developing countries is frequently organized in the informal sector, where livelihoods of poor people are directly dependent on the recycling economy.

6. Approaches have evolved over time to examine product management over the course of the life cycle. These "cradle to grave" approaches (where "grave" implies that disposal is still the default option for dealing with waste) have more recently begun to be supplanted by a "cradle to cradle" approach, which stresses much more centrally the recovery of economically useful materials to be fed back into production processes. At the same time, waste minimization has come to occupy a more central place in waste policies. This shift in emphasis has gone hand in hand with a focus on dematerialization, whereby the goods and services that people value are delivered using fewer materials (along with less energy). With this evolution in waste management philosophy and approach has come an evolution in waste management policies and practices.

7. For dynamic urbanizing economies, defining a long-term waste management strategy for the coming decades is critical to fostering sustainable waste management. An effective long-term strategy must include the operationalization of integrated sustainable waste management systems, which comprise a variety of activities, including reduction, reuse, recycling and composting, operated by a variety of stakeholders at various scales. Not only technical and operational aspects, but also financial, training, legal, institutional and economic factors and linkages must be addressed in an integrated manner in order for a system to function sustainably.[3]

8. A key challenge is to devise integrated waste management systems that effectively incorporate the informal sector and communities, upgrading both their

[2] *Trends in Sustainable Development: Chemicals, Mining, Transport and Waste Management* (United Nations publication, Sales No. E.10.II.A.5), p. 30.

[3] United Nations, Department of Economic and Social Affairs, "Innovative approaches and strategies for integrated waste management" (2010).

skills and their working and living conditions. The informal sector's contribution normally includes the collection, recycling and disposal of solid wastes, while communities can be involved in decentralized composting. The lack of such integrated strategies hinders environmental improvement and perpetuates the extreme poverty of informal sector waste-pickers.

9. Implementation of new strategies on management of waste, including hazardous waste, requires coordinated efforts by international agencies, local governments (within their jurisdictions), national Governments, civil society and the private sector. Privatization contracts and legislation should be flexible enough to permit the participation of small-scale service providers.

10. To manage waste effectively, a long-term strategy should also include the development of a public awareness programme, and waste management infrastructure planning, as well as economic instruments such as household user fees, landfill taxes, and deposit-refund schemes to encourage consumers to reduce waste and increase recycling (see boxes I and II). The strategy should consider programmes and legislation on extended producer responsibility which encourage recycling and discourage the production of goods that are difficult to recycle. Economic returns from resource saving measures should be considered in overall policy and planning. Additionally, policy decisions must be sustained despite changes in leadership.

Box I

Incentives for waste reduction: Volume-based waste fees collection system — Republic of Korea

Prior to 1995, all municipalities in the Republic of Korea levied waste fees on households through a property tax or monthly lump-sum fee. Under this fixed-fee system, as the cost per residence remained constant regardless of the amount of waste generated, there were no incentives for households to reduce the waste they produced. Introduced in 1995, the volume-based waste fee system of the Republic of Korea is a pay-per-sack scheme under which households are required to place residual waste in prepaid sacks, while recyclables are collected free of charge. Different municipalities levy different charges for their bags under the scheme. For example in Yongsan-gu, prices range from 100 won for a 5-litre bag up to 1,780 won for a 100-litre bag for general waste.

In the Republic of Korea, the quantity of municipal solid waste was reduced by 15.95 per cent in the period from 1994 to 2006. Meanwhile, the recycling rate increased from 15.4 to 57.2 per cent over the same period.

Source: Adapted from K. Y. Kim, Performance of waste management policy in Korea: volume-based waste fee system and packaging waste extended producer responsibility (Republic of Korea, Ministry of Environment, 2008), policy paper.

Box II
Economic incentives for recycling in Brazil

In Latin America, there are wide variations in the practice of recycling across countries, owing largely to the systems of rewards and punishments that are in place. According to Brazil's Aluminium Association, about 80 per cent of the 9.5 billion aluminium cans sold in 2000 were recycled, which means that Brazil ranks with, for example, Japan among the world's recycling leaders. Whereas Japan bases its system upon responsible citizenship, Brazil uses economic incentives. In the major metropolitan areas, there are many recycling centres which buy back recyclable materials for cash or discounts on food.

Source: Report of the Secretary-General on the review of the implementation of Agenda 21 and the Johannesburg Plan of Implementation: waste management (E/CN.17/2010/6).

B. Improving waste management systems, infrastructure and technology

1. Improving informal systems of waste management

11. The recycling segment of the waste industry in developing countries is predominantly controlled by the informal sector. Typically, 1 per cent of the urban population in developing countries is involved in informal scavenging and a major proportion of the scavengers includes women and children. A recent estimate reveals that up to 15 million people engage in waste collection for their livelihood (see boxes III and IV). Over half a million waste-pickers have been reported in Brazil and the country has close to 2,400 companies and cooperatives involved in recycling and scrap trading. In the city of Buenos Aires, the economic impact of waste scavenging has been estimated at US$ 170 million per year; and India is estimated to have at least 1 million waste scavengers. Estimates from several cities and towns of developing countries of Asia and the Pacific show that as much as 20-30 per cent of the waste generated in cities is recycled by the informal sector.[4]

[4] United Nations Environment Programme report on "Waste management as a sector of Green Economy" (to be released in February 2011), p. 8.

Box III

Addressing issues of informal waste-pickers in Brazil

In Brazil, organized waste-pickers are seen as legitimate stakeholders and have established formal contracts with businesses. The cash transfer programme *Bolsa Família* compensates families for shifting their children from waste-picking to school attendance, which has helped at least 40,000 children to have access to education and good health. Brazil houses at least 500 waste-picker cooperatives, with about 60,000 members. Some of them enable their members to earn US$ 300 per month, which is twice the minimum wage.

Source: M. Medina, *The World's Scavengers: Salvaging for Sustainable Consumption and* Production (Plymouth, United Kingdom, Altamira Press, 2007). Available from http://books.google.com/books?id=daCm1Eck0pkC&printsec=frontcover&dq=the+world's+scavengers+by+martin+medina&source=bl&ots=ZlvpYA7CKe&sig=vv-m1C5_8dmc02Hh-mRCrH8NZa4&hl=en&ei=vTYdTeTDHIPZce3N1Z0K&sa=X&oi=book_result&ct=result&resnum=1&sqi=2&ved=0CBYQ6AEwAA#v=onepage&q&f=false.

Box IV

Addressing issues of informal waste-pickers in Egypt

The *Zabbaleen*, a minority community in Cairo, has been engaged in informal waste-picking since the 1930s. After the establishment of associations in the 1970s, and the beginning of a Zabbaleen Environment and Development Programme in 1981, with support from the Ford Foundation, the World Bank, Oxfam and other entities, the working conditions and basic infrastructure for waste collection and sorting were improved considerably. A primary school, a paper recycling project, a weaving school, a health centre and a small industries project have been established to support waste-pickers.

2. Strengthening capacities to manage growing and increasingly diversified waste streams

12. Industrialization, urbanization, growing populations and consumptive lifestyles have led to an exceptional increase in the quantum and type of waste generated around the globe. Per capita waste generation rates in many developing countries have now crossed the one-kilogram-per-day mark. Industrial waste generation rates are also very high, as many industries are primary industries producing raw materials for further processing. Understanding the scale of generation of various categories of waste is fundamental to establishing the appropriate policies. A number of new waste streams have emerged, including e-waste and hazardous waste especially.

13. The complexity, costs and coordination of waste management require multi-stakeholder involvement at every stage of the waste stream process and intensive capacity-building of all stakeholders including, but not limited to, technical

personnel in local governments, municipalities and other related institutions who are usually responsible for the development and implementation of waste management plans.

14. Comprehensive efforts need to be put in place to strengthen capacity, including development and dissemination of training packages, manuals and guidelines on various aspects of waste management, technology compendiums, awareness-raising materials, case studies and best practice. A comprehensive online information clearing house could be developed for easy accessibility by different users. Series of workshops and training programmes need to be conducted in all regions. Efforts should also be made to provide hands-on experience through demonstration projects. A network of capacity-building institutions could help to institutionalize the effort.

3. Improving access to appropriate technologies and infrastructure

15. In achieving national waste management goals, Governments need to identify the best infrastructure as well as the best technology in terms of their appropriateness and feasibility of application. Such identification and choice would depend on resource requirements and local applicability.

16. While the success of developed countries has, to a certain extent, been due to the adoption of modern technologies at every stage of waste management (from waste collection through segregation, recovery/recycle, transport, treatment and disposal), the extent of the infusion of modern technologies in developing countries has been rather limited and efforts in this regard need to be intensified if effective waste management is to be realized. Many cities in developing countries have not been able to set up adequate systems for the collection of municipal and industrial waste owing to a poor infrastructure base; in rural areas, waste management infrastructure is largely non-existent. Economic and financial limitations have forced many developing countries to adopt technologies on the basis mostly of cost considerations rather than of sustainability criteria.

17. Organic waste, which is still a sizeable portion of waste in many developing nations, should be suitable for reduction through composting. As regards incineration, the high start-up and operational costs are a major barrier to successful adoption of this technology in many developing countries.

18. There is a need in developing countries for information exchange with, and dissemination of waste treatment technology (particularly innovative reduce, recycle and reuse (3R) technology) by, developed countries. For the Western Asia region, a high priority is the strengthening of waste management capacities of local authorities. Meanwhile in Africa, the application of advanced small-scale digesters to produce biogas (see box V), as well as composting of fertilizer and/or animal feed from organic waste, needs to be implemented more widely. In some developing countries in Africa, South America and Asia, large-scale utilization of waste-to-energy plants could be feasible, which would benefit from the involvement of private companies.

19. To determine appropriate technologies, assessment methodologies such as Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, GAP analysis and Political, Economic, Social, and Technological (PEST) analysis, as well as technology assessment methodologies, such as Sustainability Assessment of

Technologies (SAT), life-cycle assessment, Cleaner Production-Energy Efficiency (CP-EE) assessment and cost-benefit analysis, could be applied.

20. There is a need as well to develop and disseminate technology databases and create platforms where technology suppliers and technology acquirers can interact and establish partnerships.

Box V

Biogas digester: case study of China

In Shipai Village, Jianshi County, Hubei Province, China, more than 90 per cent of a total of 227 households have installed a 10-cubic metre (m^3) biogas unit. The gas produced per household on a daily basis, which is used for both lighting and cooking, amounts to 1.0-1.2 cubic metres. This has resulted in a savings on electricity and coal of 136 renminbi per year. Use of digested slurry has resulted in a savings on chemical fertilizer. The annual labour savings are substantial. In addition, social benefits have been realized, such as employment for technicians, improvement of health and increased participation in social work by women.

Source: Report of the Netherlands Development Organization (SNV) (2006), see also www.unapcaem.org.

4. Increasing research on and development of region- and country-specific technologies

21. The fact that waste quantities and characteristics are location-specific requires technologies to be adapted to local conditions. In the area of research and development of region- and country-specific technologies, countries should:

- Strengthen research and development institutions by building indigenous capacity to undertake targeted work on development and adaptation of waste management technologies. This should not be limited to disposal technologies but should also include other aspects of waste management such as: segregation systems, treatment of waste, recycling technologies.
- Test the application of such technologies in the context of developing countries through pilot demonstration projects so as to build confidence. This in turn will require extensive data collection on waste characterization and quantification to facilitate design and development of technologies.
- Strengthen capacity of decision makers in the area of technology assessment and selection.
- Develop information systems and/or technology databases, including new and cutting-edge recycling technologies.
- Develop locally relevant technologies.

5. Improving data collection, analysis and monitoring

22. Availability of reliable and representative data is a crucial requirement for the design of waste management systems and the formulation of appropriate policies. However, obtaining such data is a difficult undertaking in many countries. Definitions vary across countries, as do reporting disciplines. Despite efforts by international organizations to facilitate comparison by providing standardized methods for reporting waste-related data, the exercising of caution is quite often required when utilizing those data.

23. There is an urgent need to improve the data collection and reporting process, which could be achieved by:

- Developing internationally agreed-upon procedures for data collection and analysis and reporting formats.
- Persuading governments, both national and local, to collect reliable and representative data, which in most cases will require intensive fieldwork, monitoring and analysis. The data would need to be updated periodically, as the waste quantity and waste characteristics will be rapidly changing.
- Developing an international waste database, which should be highly comprehensive and include all types of data, for example, on waste quantification and characterization (local level aggregated to national level); collection and recycling; policies and regulations; and monitoring and analytical capacities.

C. Sustaining the implementation of environmentally sound waste reduction, reuse and recycling

24. Experience has shown that the issue of waste management needs to be addressed through integrated approaches and requires the involvement of various stakeholders. Reducing waste production, recycling waste and reusing materials should form the basis for sustainable waste management. An ideal framework for sound waste management could build on the 3Rs (reduce, reuse and recycle). However, there is no set model for establishing sound waste management in a particular area. Instead, what is required is outside-the-box thinking and an assessment of potential stakeholders' involvement which is dependent on the specific scenario presented by a town, community, city or country.

25. In developing countries, oftentimes the public sector is ill equipped to take on the task of waste management, despite the size of its share of local government resource allocation. In many cases, between 20 and 50 per cent of a municipality's budget is spent on solid waste management alone. Success requires cooperation and partnerships, including greater involvement of the private sector, so that the burden imposed on government budgets can be relieved. Some Governments have already outsourced to the private sector certain waste management functions.

26. One of the main reasons for current unsustainable waste management is the fact that waste is traditionally thought of as having no value. Creating incentives that make waste minimization financially rewarding can change this perception, as can promoting awareness among key stakeholders on the related benefits and the know-how to be derived from sound waste management. This can be achieved

through a variety of approaches, including education — formal, non-formal and informal — as well as public awareness campaigns and demonstrations to showcase techniques and cost-saving opportunities associated with resource efficiency and sound waste management. Other measures that can effectively raise awareness include the utilization of environmental accounting systems that factor in the waste costs of a product and corporate environmental information disclosure (CEID), which reveals information about a firm's environmental performance to its consumers, its investors, the Government and the community at large.

D. Strengthening the implementation of effective e-waste and hazardous waste policies and strategies

27. Electrical and electronic waste (e-waste) generation is steadily increasing owing to large-scale use of electronic and electrical equipment and e-waste is one of the fastest growing segments of the waste stream. It is estimated that 315 million personal computers became obsolete in 2004, and 130 million mobile phones were disposed of in 2005 (see box VI). In 2008, more than 1 in 3 people worldwide — 2.5 billion in total — used a mobile phone and that figure is expected to rise by a factor of up to 400 million new subscribers each year. While this trend is responsible for immeasurable advances worldwide, discarded mobile phones are posing a growing and potentially alarming environmental threat.

Box VI
Mobile Phone Partnership Initiative and Partnership for Action on Computing Equipment

The Mobile Phone Partnership Initiative (MPPI) was launched in 2002, during the sixth meeting of the Conference of the Parties to the Basel Convention, when 12 manufacturers signed a Declaration whereby they entered into a partnership under the Basel Convention, and in cooperation with other stakeholders, to develop and promote the environmentally sound management of end-of-life mobile phones.

Following the success of the Partnership Initiative, the Partnership for Action on Computing Equipment (PACE) was launched at the ninth meeting of the Conference of the Parties to the Basel Convention, which was held in Bali, Indonesia, in June 2008. PACE is a multi-stakeholder partnership that provides a forum for Governments, industry, non-governmental organizations and academia within which to tackle the challenges of environmentally sound management, refurbishment, recycling and disposal of used and end-of-life computing equipment.

28. Next to municipal solid waste, hazardous waste (including industrial, health-care and domestically produced hazardous wastes) constitutes a major component of global waste statistics. The Basel Convention has estimated the amount of global hazardous waste at 338 million metric tons per year and transborder movements as accounting for close to 9 million tons.

29. Although some countries are taking steps in the right direction, many developing countries and countries with economies in transition still do not have the necessary expertise and infrastructure to handle and manage e-waste and hazardous waste in an environmentally sound manner. Collection, treatment and disposal of hazardous waste are beyond the traditional capacity of the local governments that manage municipal waste. Numerous obstacles have been identified by developing countries in regard to their ability to manage these waste streams in an environmentally sound way. These include: lack of easily accessible information (on flows, quantities, available technology, and legislative and trade requirements of countries importing new products, which increasingly require strict standards for minimization and reuse, recycling and recovery); lack of trained personnel; inadequate legislation; inadequate infrastructure for collection, recycling and recovery; lack of public awareness; and lack of economic alternatives to activities carried out by the informal sector and small family repair shops.

30. A comprehensive e-waste management approach should address technical and financial capacity requirements and create an enabling environment focusing on policies and financial incentives that will attract the private sector.

31. Projects should also be in place for developing a comprehensive inventory of sources, quantities and composition of e-waste and hazardous waste. Both end-of-the-pipe and prevention-at-source strategies should be devised to ensure the abandonment of unsound practices. Local as well as national Governments should renew their efforts to raise awareness, mobilize all stakeholders, encourage and facilitate environmentally sound management of e-wastes during their collection, storage, and transport to repair or refurbishment workshops. Capacity-building and training, particularly of small businesses, will contribute to the improvement of quality control in the repair and refurbishment workshops, and will yield both environmental benefits and benefits to workers' health, without compromising the economic returns.

32. Large quantities of e-waste are being exported to developing countries for the purpose of reuse, repair, refurbishment, recycling and recovery of non-ferrous and precious metals at facilities that do not always operate under sound environmental conditions. Some end-of-life equipment is exported in the guise of donations and charitable contributions.

33. Significant quantities of hazardous waste are transported to developing countries in Africa, Asia and the Caribbean and, increasingly, to Eastern and Central Europe. The United States of America exports more than 50 per cent of its e-waste to countries such as India and China. The average cost of recycling a single personal computer in the United States is $20, while in India the same activity would cost just $2 per machine. According to Greenpeace, in 2003, in the United Kingdom of Great Britain and Northern Ireland alone, at least 23,000 metric tons of undeclared or "grey" market electronic waste were shipped illegally to the Far East, India, Africa and China. Import and export statistics provided by the parties to the Basel Convention for the year 2000 indicate that there were imports of more than 17.5 million tons designated as used electrical and electronic assemblies or scrap.

34. In this context, international cooperation is crucial, the market should be regulated and strict control over the import and export of hazardous wastes should be enforced. There is a need as well to enhance the ability of countries, especially developing nations, to implement and enforce the provisions of the Basel

Convention. This would require the strengthening of national and regional mechanisms designed to support multilateral agreements and would include the promotion of information-sharing and sanctions against illegal trafficking.

E. Management of specific wastes

Radioactive waste

35. Practically all countries generate radioactive waste, whether from the production of nuclear energy, from the use of radioisotopes for medical diagnosis and treatment, from the use of nuclear methods for improving crops and food safety, or from various research and industrial applications. National Governments should ensure that appropriate safety measures are applied to the management of the radioactive waste that their economies generate. National strategies, plans and corresponding actions for managing radioactive waste must be developed. The establishment of a proper legal framework, regulatory infrastructure, policies and strategies is a prerequisite in this regard.

36. Internationally, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management is the only legal instrument directly addressing these issues on a global scale and is thus an important tool for advancing the safe management of radioactive waste and spent nuclear fuel. The Joint Convention, a treaty under the auspices of IAEA, aims to achieve and maintain a high level of safety worldwide. Every three years, the contracting parties thereto (57 as of August 2010) prepare national reports for their review meeting. The radioactive waste managed by contracting parties to the Joint Convention covers 90 to 95 per cent of all radioactive waste that is generated globally; for spent nuclear fuel, the percentage is even larger. The Joint Convention is useful not only for countries that have nuclear power programmes but also for countries that use radioactive material solely in medical and industrial applications.

37. In addition to its responsibilities under the Joint Convention, IAEA contributes to the safe management of radioactive waste by publishing safety standards and providing assistance to member States in their application, which includes technical cooperation, training, peer reviews and advisory missions on regulatory frameworks and national infrastructure.

Health-care waste

38. Inadequate and inappropriate handling of health-care waste may have serious public-health consequences and a significant impact on the environment. Sound management of health-care waste is thus a crucial component of environmental health protection.

39. Epidemiological studies indicate that a person who incurs one needle-stick injury from a needle used on an infected source patient has risks of 30 per cent, 1.8 per cent and 0.3 per cent, of becoming infected with hepatitis B virus (HBV), hepatitis C virus (HCV) and HIV, respectively. In both the short and the long term, the actions involved in implementing effective health-care waste management programmes require multisectoral cooperation and interaction at all levels. Policies should be devised and coordinated globally, with the management practices implemented locally. Establishment of a national policy and a legal framework,

training of personnel and raising public awareness are essential elements of successful health-care waste management.

40. Key priorities are: to ensure that appropriate resources are allocated to support the implementation of national health-care waste national plans; to also ensure, when planning for mass immunization campaigns, that the facilities necessary for safe treatment and disposal of large amounts of waste produced in a short period are made available well ahead of time; and to further ensure that appropriate and affordable technologies for health-care waste treatment are developed and implemented locally (see box VII).

Box VII
Bir Hospital, Kathmandu

As Nepal has no medical waste management infrastructure, many hospitals simply dispose of infectious waste along with the municipal waste which piles up on city streets. Bir Hospital, Kathmandu, with about 400 beds, is Nepal's oldest hospital. It is run by the National Academy of Medical Sciences. It has recently installed two 175-litre autoclaves in a dedicated waste treatment facility in order to combat this public-health threat and practices in model wards are being expanded. Health Care Foundation Nepal, Health Care Without Harm and the World Health Organization are supporting the effort.

A waste management committee has been established and hospital staff have helped develop segregation procedures and adapt trolleys to segregation of waste at the bedside. To foster waste management: syringes are destroyed immediately after use by needle cutters and destroyers; mercury thermometers and sphygmomanometers are being replaced; infectious waste is transported to the treatment centre separately and dealt with in different parts of the building; non-infectious plastic, paper, glass and metal are sold to recyclers; and infectious waste is disinfected in autoclaves which have been validated using chemical and biological indicators and are regularly tested to ensure that they continue to work effectively.

Marine waste

41. The influx of litter into the world's oceans is estimated to exceed 6.4 million tons annually and the diversity, distribution and volume of that litter are increasing. While there are regional variations, approximately 80 per cent of marine litter comes from land-based sources. This is a global issue, affecting many coastal areas, enclosed or semi-enclosed seas, and all the oceans — both on and below the water's surface. The solid waste can negatively impact humans, wildlife, habitats and the economic health and stability of coastal communities. As the international community has just concluded its celebration of the International Year of Biodiversity, it is important to highlight the fact that litter can lead to loss of marine biodiversity (for example, through accidental catch by "ghost" nets), loss of ecosystem functions and services, loss of revenue (for example, from reduced catch and reduced tourism), loss of livelihoods of community groups, and increased costs

(incurred owing, for example, to beach clean-ups). Modest estimates indicate that the cost of marine litter to the 21 Asia-Pacific Economic Cooperation (APEC) countries alone is US$ 1.3 billion per year. In Australia, close to $6.5 million is spent annually on clean-up activities.

42. It is essential to improve awareness among Governments, communities and industry of the economic and environmental implications of marine litter and to provide guidance and practical advice on targeting resources so as to mitigate the impacts of marine debris. There are three actions to be considered by the policymaker: prevention of litter generation and entry into the sea; observation of ambient marine litter stock levels at sea; and clean-up of litter once it is in the ocean or on the coasts. A diverse strategy comprising regulations, market-based instruments and community initiatives is required to address the marine litter problem.

Plastic waste

43. The world's annual consumption of plastic materials has increased from about 5 million tons in the 1950s to nearly 100 million tons at present; thus, 20 times more plastic is produced today compared with 50 years ago. Waste plastics are becoming a major component of the solid waste stream. It is estimated that plastics constitutes 15 to 40 per cent of municipal waste, with the proportion depending upon the economic profile and lifestyle and consumption patterns. Large quantities can be found as litter spread on land and at sea, which is being burned, buried or open-dumped. Wherever possible, plastic should be replaced with biodegradable materials; and production of biodegradable plastics should be considered.

44. The negative impacts of unavoidable waste plastics can be addressed or minimized by recycling and converting them into a valuable resource. In most situations, plastic waste recycling could be economically viable, as it generates resources that are in high demand. Plastic waste recycling also has greenhouse gas emission reduction potential on two counts: (a) the fuel generated from waste plastic can replace an equivalent amount of fossil fuels; and (b) the formation of pockets of anaerobically decomposed organic waste resulting from the co-disposal of waste plastic in landfills can be avoided.

45. Plastic waste recycling is feasible through mechanical recycling (also called material recycling) which entails utilization of the technologies that reprocess waste plastics into similar or different plastic products without modifying their initial chemical structure. These technologies have the potential for creating cheaper products, as in most cases recycled plastic costs less than virgin plastic.

46. Feedstock recycling (or chemical recycling) is a viable alternative: plastic waste is recycled as raw materials, fuel oil and industrial feedstock by altering its chemical structure. These products reduce the dependence on scarce materials: for example, through the partial replacement in steel production of metallurgical coke with plastics. Combustion of plastic waste can be used in energy recovery (or thermal recycling).

Metal waste

47. Metals possess the advantage of being inherently recyclable and can, in principle, be used over and over again, thus saving energy and minimizing the

negative environmental impacts associated with the mining of virgin material. The UNEP Resource Panel has stated in a recent report that for only a limited number of metals, such as iron and platinum, is the end-of-life recycling rate above 50 per cent. Still, despite the often low recycling rates, there is significant potential for improvement.

48. Globally, the growing metal stock can serve as huge mines above ground. Exploiting this potential can contribute to a reduction in the extraction of metals from primary sources and would also contribute to the decoupling of resource use from economic growth and thereby result in considerable energy savings.

F. Improving agricultural waste management

1. Developing national laws on agricultural waste management

49. There is an urgent need to develop national waste management strategies and national laws on agricultural waste management, including disposal of pesticide containers. Currently, agricultural legislation focuses primarily on agricultural production and worker and consumer protection. Waste-related provisions in agricultural legislation most frequently consist in references to specific waste or wider environmental legislation. Provisions that are directly or indirectly related to waste treatment and disposal should be included in national legislation.

50. FAO recommends that national pesticide law should address the issue of the disposal of empty pesticide containers and other pesticide-related waste as well as disposal of unwanted, unusable or obsolete stocks of pesticides, in order to prevent harmful consequences for human health and the environment. A pesticide law should follow international guidelines for disposal of empty pesticide containers, related waste and unused or obsolete pesticide stocks.

2. Recovering energy from biomass waste

51. The use of agricultural residues as a source of material and energy can offer developing countries the twin benefits of proper management of their waste and generation of renewable energy and materials. Additionally, biomass is an indigenous energy source available in most countries — one that can enable diversification and enable a more secure fuel supply in many situations. Apart from its extraction from direct sources, huge amounts of biomass are generated as by-products of agricultural (and wood) harvesting and processing activity.

52. To promote the use of biomass waste as a source of energy, Governments should frame and implement cross-cutting policies that underscore the importance and potential of biomass waste as a source of energy, and establish suitable financing schemes to provide funds for implementing waste-to-energy technologies. Governments, with the assistance of development partners, should develop capacity-building programmes on actions related to various aspects of waste agricultural biomass, including assessing of quantity and characterization, assessing appropriate technologies, selecting and implementing technologies, and developing a business case for converting waste agricultural biomass into an energy source.

3. Utilizing biomass waste for soil quality enhancement

53. Biomass produced as a by-product of cropping systems is often disposed of by burning or landfilling. In some sectors, such as organic agriculture, use of such material for soil improvement has been widely practised for many years, and the practice is increasingly being taken up by mainstream farmers. In conservation agriculture, instead of crop residue's being burned after the harvest, or biomass's being ploughed into the ground, they are left in place as soil cover. Besides reducing mineralization, erosion and water loss, the surface cover inhibits the germination of weeds, protects soil microorganisms and helps build up the supply of organic matter. As a result, less time and labour are spent on land preparation, and there is lower fuel consumption and less air pollution, reduced need for chemical inputs, and an increase in yields and farm income. Recent studies estimate that conservation agriculture is practised on about 100 million hectares of farmland, mainly in North and South America, but also increasingly in Africa and Asia. Developing countries, in particular, should use biomass as a low-cost alternative for soil quality enhancement.

54. Composting is another affordable technology which enhances the suitability of raw organic materials such as crop residues and animal waste for application to the soil as a fertilizing resource. Compost is a rich source of organic matter. Soil organic matter plays an important role in sustaining soil fertility and ensuring sustainable agricultural production. In addition to being a source of plant nutrients, it improves the physicochemical and biological properties of the soil.

III. Strengthening an enabling environment for implementation

A. Providing capacity-building and technology transfer for effective waste management

55. Capacity-building at all levels is a key success factor in the strengthening of the enabling environment for implementation of the reduce, reuse and recycle (3R) strategy, waste prevention and waste management projects and programmes, including successful technology transfer. If they are to achieve environmentally sound management and minimization of wastes in a sustainable and effective manner, programmes must go beyond purely technical considerations to the formulation of specific objectives and implementation of appropriate measures designed to address political, institutional, social, financial, economic and technical factors.

56. Experience shows that integrated approaches linking awareness-raising, training, promotion of enabling framework conditions and policies, and, when appropriate, technology transfer are effective in creating local capacity for waste prevention and management. The establishment of systems for quantifying, monitoring and disseminating results is crucial to ensuring sustainability and replication. Private sector involvement in waste management systems requires a shift in the role of government institutions from service provision to regulation, which may require the development of new institutional capacities (including competitive bidding, technical and organizational capacity, regulatory instruments and monitoring and control systems) to ensure that the conditions necessary for successful private sector involvement are in place.

57. A key success factor is the establishment of institutional mechanisms that facilitate cooperation across traditional institutional structures in ways that stimulate increased waste prevention. Multilevel national/regional/local government partnerships are useful in ensuring that waste prevention activities at various levels are mutually reinforcing. Government and municipal efforts in the area of waste prevention can be promoted through seeking the perspectives of stakeholders (for example, by securing their input during target-setting, instrument choice and application, and performance evaluation).

58. Successful technology transfer involves not only the selection and shipping of equipment, but also the adaptation of that equipment to local circumstances, the training of local technicians, and the long-term upkeep and use of the equipment, and thus requires both capacity-building and the promotion of an enabling environment for technology uptake, development and diffusion. The successful transfer of environmentally sound technologies requires recipient countries to have the requisite institutional resources and competencies (see box VIII). If these are not in place, then projects need to incorporate strategies to address the issue, for example, through capacity-building measures or activities aimed at improving access to resources. Existing market conditions and market forces need to be considered in the design of technology transfer projects; and barriers need to be identified and addressed, for example, through the creation of policy instruments, awareness-raising or other measures.

59. Technology transfer should help strengthen research and development systems and promote the capacity to develop new technologies and solutions. Availability of accurate, timely and authoritative information — including explicit information on government policies, cost and performance of new technologies, opportunities for international support, and the long-term implications of the introduction of the necessary technological change — is critical to project success. Effective strategies include developing niche research areas, particularly in institutions with limited funding, as well as creating research centres and strengthening research infrastructure.

Box VIII

Transfer of environmentally sound technologies for cleaner management of municipal solid waste in Havana City

The main emphasis of this project was to enable ministerial, provincial and municipal staff to design and implement municipal solid waste strategies that suited the needs of the country and were in accordance with the requirements of ecologically sound natural resources management. The project aim was to improve the capability of the targeted region in the area of municipal solid waste management through capacity-building at municipal, provincial and central levels. This was achieved, on the one hand, through theoretical training and on the other, through the practical experience acquired implementing selected demonstration projects. The project was based on an integrated approach including awareness-raising, local capacity-building and training, transfer of environmentally sound technologies and transfer of know-how. A central part of the project was capacity-building of all persons involved.

Key project results included the establishment of an integrated system for separate collection of different municipal waste streams and subsequent management (including a laboratory for waste analysis, a biogas plant and compost production). Furthermore, Cuba's Ministry of Economy and Planning has instructed other municipalities to examine the means of effecting the introduction and application of separate collection of municipal solid waste in their municipalities, while adjusting their activities to local conditions using locally available resources.

Source: Project implemented by the United Nations Industrial Development Organization and the National Cleaner Production Centre, Cuba, with financial support from the State Secretariat for Economic Affairs, Switzerland (project duration: 2005-2009).

B. Financing and investing in sustainable waste management

60. Waste management costs are increasing. Developing countries spend 60 to 70 per cent of their waste budget on collection, with complete municipal solid waste-related services consuming 1 to 2 per cent of a country's GDP. In developed regions, the cost of waste segregation ranges from $107 per ton for mixed collection to $1,320 per ton for segregated collection. The capital cost of incinerators may range from $100,000 to $200,000 per daily metric ton of capacity, compelling the owner to invest at least from $30 million to $600 million initially. The annual cost per metric ton of waste burned amounts to $30 on average. The additional cost of treatment of residual ash in a special landfill can range from $200 to $500 per metric ton. In a typical city with a population of 50,000, the costs of landfilling and incineration are $95 and $147, respectively.

61. Government investments in waste management services have increased over recent years. Energy recovery projects have been the recent focus of Government investments in developed countries. The United Kingdom has allocated US$ 16.5 million for anaerobic waste-to-energy projects. China is planning to allocate 862.9 billion renminbi (US$ 126 billion) to promote provision and construction of municipal solid waste management infrastructure.

62. Government funding has often been insufficient, however, in respect of meeting the growing demand for waste management services in both developed and developing countries. Through private participation, many investment barriers have been addressed successfully based on flexible financing options. The growing number of waste-related private finance initiatives in the United Kingdom reflects the emerging interest of the public sector in private involvement in the industry. Engaging the private sector has reduced the waste service cost by at least 25 per cent in countries such as the United Kingdom, the United States and Canada and by at least 20 per cent in Malaysia. Developing countries should create an environment that encourages the creation of public-private partnerships (see table).

Public-private partnership arrangements, Latin America, the Philippines and Dakar

Location	*Project details and benefits*
Latin America	• Higher labour and vehicle productivity, which has reduced the service cost by about 50 per cent
Philippines	• A privately built special high-temperature incinerator for infectious health-care wastes is being used by more than 200 medical centres and hospitals
Dakar	• A public-private joint venture initially monopolized the sector but later competitive privatization arrangements were introduced for multiple service contracts

63. Financing options such as microfinancing and hybrid financing have been successful in meeting project costs in several regions of the world. For example, the participatory sustainable waste management project established in 2006 in Brazil created microcredit funds through donations. These funds were used as a source of working capital for financing transportation and for emergencies. The funds were also used to extend loans for waste-pickers, who repaid their loans after receipt of payment from recycling depots.

64. In another example, microfinancing has been provided to microenterprises managing a 40-year-old garbage heap of 2 million metric ton capacity (known as Smokey Mountain) in Metro Manila. The microenterprises are involved in the collection, sorting and sale of waste through a material recycling facility. Microfinancing enabled those enterprises to secure loans and increase their capacity to generate revenue.

65. Hybrid financing models are being increasingly explored to rekindle and/or close economically challenged waste management projects. In the United Kingdom in 2003, the Government introduced an innovative financing option called prudential borrowing. The Government Department of Environmental, Food and Rural Affairs recommends applying the option for low-risk investments, for example, in recycling centres and land acquisition. In one case involving the West Sussex County Council, the low-risk component of a mechanical biological treatment process (representing about 60 per cent) was funded through prudential borrowing.

66. The Clean Development Mechanism (CDM), which was introduced under the Kyoto Protocol[5] to the United Nations Framework Convention on Climate Change,[6] helps to improve the financial viability of waste management projects and is a market mechanism that should be strengthened further. It is important to note, however, that the Clean Development Mechanism improves the internal rate of return of projects by a margin of only approximately 5 per cent; hence, identification of other sources of financing is critical to the project.

[5] United Nations, *Treaty Series*, vol. 2303, No. 30822.

[6] Ibid., vol. 1771, No. 30822.

C. Building partnerships

67. Various national Governments and international institutions have launched activities supporting capacity development in respect of policy frameworks, financing mechanisms (including public-private partnerships) and technology for waste management. However, efforts have thus far been scattered, uncoordinated and insufficient in terms of addressing the needs of developing countries. The complexity, costs and coordination required for effective waste management demand multi-stakeholder involvement at every stage of the waste stream process. There is a clear need to identify and engage all stakeholders in waste management and strengthen cooperation so that it is conducive to the creation of strong innovative partnerships at international, regional and local levels. These partnerships are needed particularly to strengthen cooperation in the areas of institutional and human capacity, research and information-sharing and technology transfer. They should also be actively engaged in advocacy, education and building awareness.

68. In this context, the United Nations Environment Programme (UNEP) proposes a global partnership on waste management designed to provide coordination, increase the exchange of best practices across countries and pool resources for the replication and scaling up of successful practices. The Department of Economic and Social Affairs of the United Nations Secretariat is also planning to launch an international partnership dedicated to addressing the needs of public waste utilities and municipalities and supporting local action plans and strategies for sustainable waste management.

IV. The way forward

69. The magnitude and gravity of the problem of adequate waste management have been amply highlighted at the eighteenth session of the Commission on Sustainable Development. The rapid increase in volumes and types of both solid and hazardous waste as a result of economic growth, urbanization and industrialization is becoming a major issue for national and local governments, particularly in developing countries, which are constrained in terms of both resources and capacity. The negative impacts on the health of surrounding communities, as well as on local environment, in terms of pollution of land, water and air, are becoming more acute. Ineffective and inefficient waste management results in greenhouse gas and toxic emissions and loss of precious materials and resources.

70. Waste management and resource recovery from waste are still low priorities of many countries, particularly developing countries, and national and local policies on waste management are not yet comprehensive enough to cover all types of wastes and all aspects of waste management. In many developed countries, policy frameworks designed to support resource recovery from waste remain inadequate.

71. The priority objectives in the field of policy options for waste management are to formulate and implement policies that promote waste prevention and minimization and support effective and efficient management of the remaining solid and hazardous wastes, focusing on reuse and recycling and on the recovery of useful materials and energy. Countries need to set time-bound targets, especially regarding

aspects like minimization and segregation, recycling and recovery, collection efficiency, treatment and environmentally sound disposal.

72. An important step should be to improve the quality and reliability of waste-related data so that the problem can be defined accurately. The data should include not only the current amount of different types of waste generated, but also the expected future amounts, in order to develop projections that will allow adequate planning for resource recovery and substitution of virgin materials. Governments may wish to create "waste cells" charged with the responsibility of collection, refinement and updating of waste data from all sources of waste generation and establishing a process of aggregation from local- to national-level data.

73. In addition to policy development and implementation, waste management systems require technology and financing to build required infrastructure. Countries need to launch intensive capacity-building programmes so as to enable concerned personnel to select, implement and operate the required technologies. Capacity of research and development institutions needs to be enhanced to enable them to undertake development and adaptation of technologies to suit local conditions; the role of international organizations in capacity-building and enhancing access to technology is crucial; and the availability of financial resources for building waste management infrastructure in developing countries needs to be enhanced. There is also a need to develop and implement innovative financial instruments for raising funds for waste management. Public-private partnerships could be further explored as a means to increase availability of and access to financial resources.

74. The social dimensions of waste management cannot be overlooked. An important aspect in this regard within the context of developing countries is the role and status of scavengers and ragpickers. Programmes need to be developed to mainstream this section of society into modernized, safe and environmentally sound waste management systems where they can earn a decent income.

75. Special attention needs to be paid to specific waste streams including e-waste, waste plastics, waste agricultural biomass, health-care wastes, industrial hazardous wastes and radioactive wastes.

76. Effective implementation of waste-related multilateral agreements and guidelines is needed at the national level. Corresponding laws, regulations and standards need to be developed and their enforcement needs to be strengthened at both the national and local levels. Economic incentives for waste minimization and recycling need to be more extensively employed.

77. Finally, it is increasingly being realized that issues related to waste management can best be tackled by promoting partnerships among and between different Governments, the private sector, development partners and other stakeholders.

78. In the future, waste has to be valued as a resource and waste management needs to be carried out with a life cycle perspective. This would go hand in hand with an increasing application by Governments of the principle of extended producer responsibility, and use of economic instruments and other sustainable consumption and production policy instruments, particularly in developed countries.

79. On the whole, these efforts would contribute to sustainable development, with the associated benefits of improved public health, poverty alleviation, creation of decent jobs, improvements in living standards, reduction of greenhouse gas emissions and other pollutants, and extension of the life of resources.